7 Kanopolis Lake

7.1 General Background

Kanopolis Lake was impounded on 17 February 1948, and reached full pool on 19 July 1948. The primary threats to water quality in Kanopolis Lake are sedimentation, nutrients, and fecal bacteria. The Smoky Hill / Big Creek WRAPS was approved in 2005 and charged with addressing water quality issues and TMDLs within the Kanopolis Lake watershed. Specific water quality goals for the WRAPS include DO concentrations > 5 mg/L, biological oxygen demand (BOD) < 3.5 mg/L, total dissolved solids (TDS) < 808 mg/L, total suspended solids (TSS) < 101 mg/L, and fecal bacteria ≤ 200 cfu/100 ml for swimming and ≤ 2000 cfu / 100 ml for boating and fishing. These water quality goals hope to be achieved through implementation of best management practices (ie, vegetative buffers, nutrient management plans) throughout the watershed.

7.1.1 Location

A dam built 293.9 km (183.7 miles) upstream of the confluence with the Kansas River on the Smoky Hill River formed Kanopolis Lake. The lake is located approximately X km (X miles) southeast of Ellsworth, Kansas. Historic water quality sample sites in the Kanopolis Lake watershed include 2 lake, 1 outflow, and 1 inflow sites (Figure 7.1).

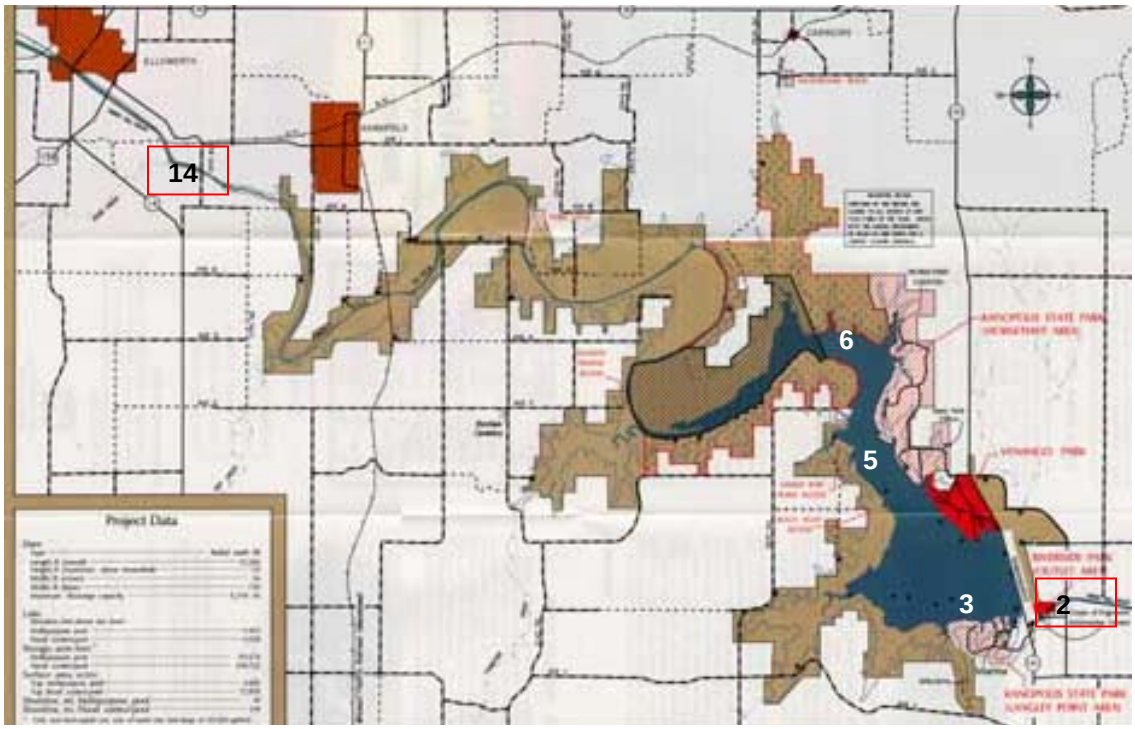


Figure 7.1. Kanopolis Lake area map with sample site locations and site numbers.

7.1.2 Authorized Purposes

Authorized Purposes: flood control, water supply, water quality, supplemental low-water flow, recreation, and fish and wildlife management.

7.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	1,508	369.3	13,958	
Multipurpose	1,463	49.5	3,406	41
Total		418.8		

Total watershed area: 7,695 sq miles (total upstream area)
2,330 sq miles (total local drainage area below Cedar Bluff Lake; 1,491,200 acres)
Watershed ratio: 106.81 FC / 437.82 MP

Average Annual Inflow: 000 acre-feet
Average Annual outflow: 000 acre-feet
Sediment inflow (measured): 28,704 acre-feet (1948 – 1993)

7.2 2005 Activities

Kanopolis Lake was categorized as an 'ambient' lake during 2005, thus only surface water quality samples were collected at the two lake sites (see Figure 7.1). Samples were collected monthly from May through September, and a single vertical profile was recorded during July. Kanopolis Lake staff (OF-KA) providing field sampling assistance during 2005 included Nolan Fisher and Jason Hurley. Ken Nelson, OF-KA Operations Manager, provided insight and background regarding Kanopolis Lake.

7.3 2005 Data

Comparative historic water quality data consists of monthly (April – September) data collected from 1996 through 2004 / 2005.

7.3.1 Inflow

No inflow samples were collected from Kanopolis Lake during 2005.

7.3.2 Lake

Total nitrogen (TN) concentrations measured in Kanopolis lake and its' inflow are some high compared to the other district lakes. Median TN concentrations from samples collected between 1996 and 2005 ranged from 1.1 – 1.3 mg/L (Figure 7.2). Annual and monthly variability in TN concentrations are evident from both inflow (Site 14) and main lake sample (Site 3) sites (Figures 7.3 and 7.4, respectively). With few exceptions, all samples from the Kanopolis Lake watershed exceed EPA's proposed ecoregional nutrient criteria value of 0.56 mg/L TN.

Median total phosphorus (TP) concentrations (0.09 – 0.16 mg/L) for all sites monitored exceed EPA's proposed ecoregional nutrient criteria value of 0.02 mg/L (Figure 7.5). There is a noticeable longitudinal decline in TP from inflow to outflow, indicating the contribution of the Smoky Hill River watershed to phosphorus loading. Such TP concentrations are typical for Kansas lakes within the district.

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios ≥ 20:1 are indicative of desirable algal communities, whereas ratios ≤ 12:1 are indicative of bloom-forming cyanobacteria (blue

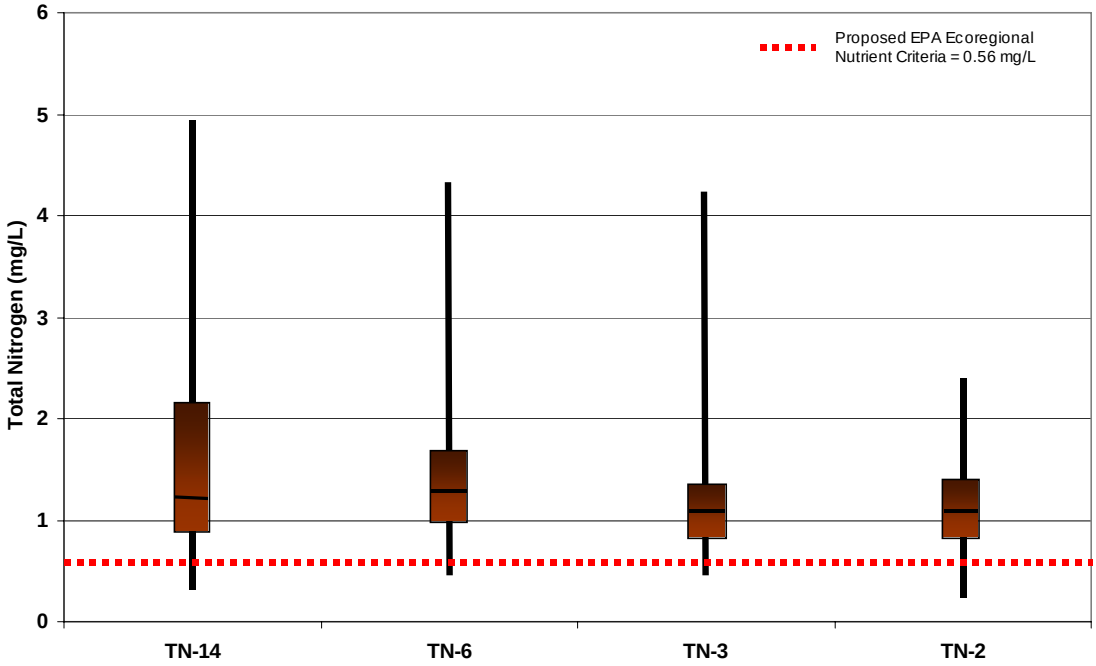


Figure 7.2. Box plots of surface water sample total nitrogen concentrations measured by site from 1996 through 2005 at Kanopolis Lake.

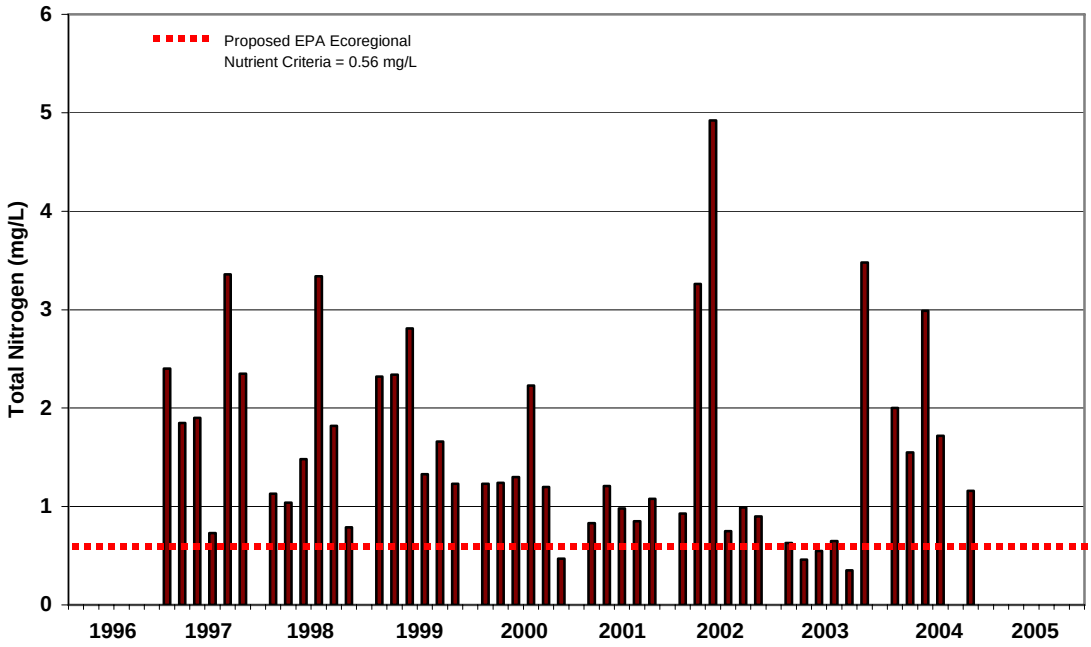


Figure 7.3. Total nitrogen concentrations by sample date collected from 1997 through 2004 at Kanopolis Lake Site 14 (Smoky Hill River inflow).

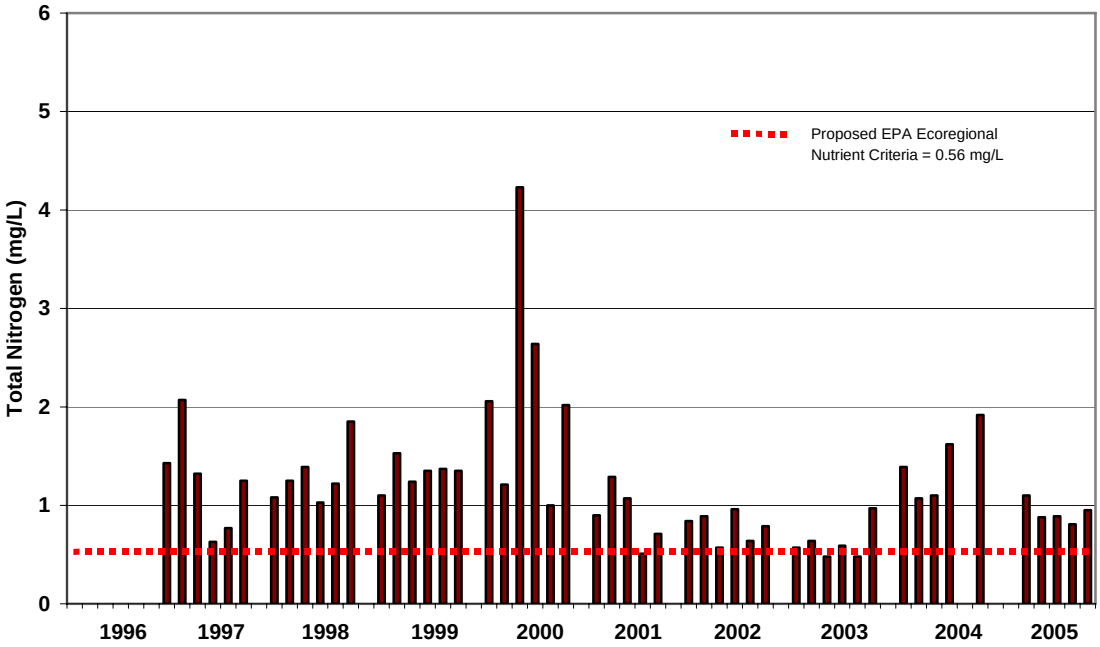


Figure 7.4. Total nitrogen concentrations by sample date collected from 1997 through 2005 at Kanopolis Lake Site 3 (Smoky Hill River inflow).

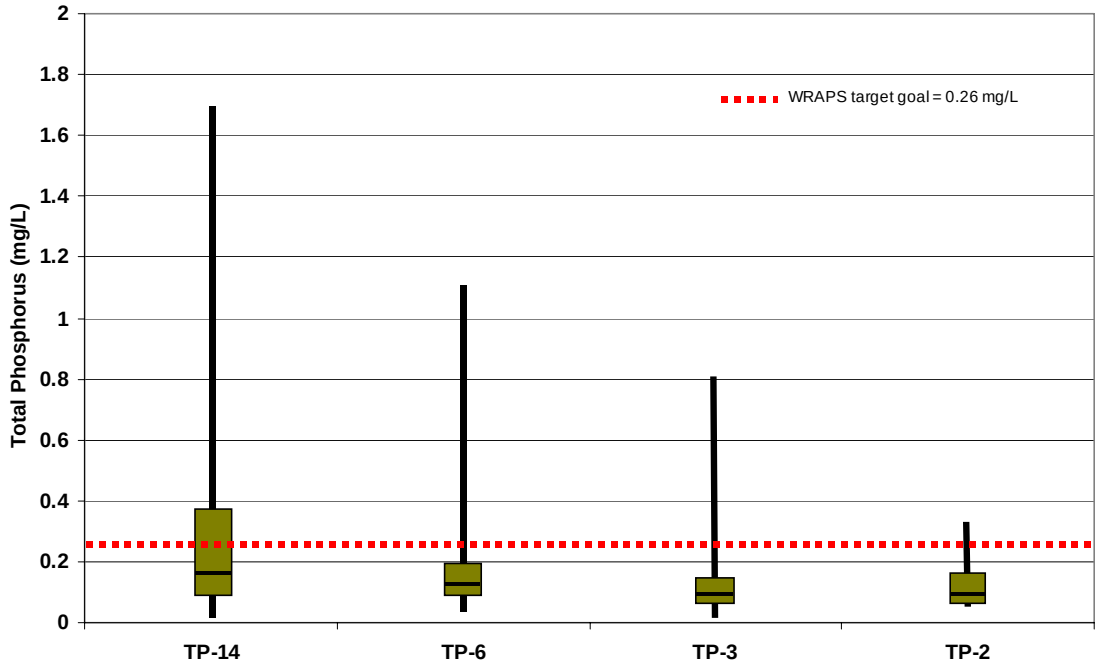


Figure 7.5. Box plots of surface water sample total phosphorus concentrations measured by site from 1996 through 2005 at Kanopolis Lake.

green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites; see Figure 7.6 as an example at Site 3. Median TN:TP ratios at both lake sites and the Smoky Hill River inflow were ≤ 12, which typically is indicative of a lake at risk for cyanobacteria blooms (Figure 7.7). However, the elevated turbidity level and limited light penetration should act to minimize cyanobacteria blooms.

Mean chlorophyll a concentrations gradually increased at both lake sites from July through September. Chlorophyll a concentrations ranged from 9 – 19 ug/L at the mid-lake site and 5 25 ug/L at the dam site. Secchi depth measured during July indicated water clarity was limited at both the mid-lake (0.45 m) and dam sites (0.54 m).

Atrazine concentrations were not collected during 2005. However, the median concentrations from samples collected between 1996 and 2004 (0.49 – 0.78 ug/L) were all below EPA's drinking water maximum contaminant level of 3 ug/L (Figure 7.8). Interestingly, samples exceeding the drinking water standard have been detected in the Smoky Hill River inflows during June of 2002 and 2003 (Figure 7.9).

A single vertical profile was recorded during the 20 July sampling trip. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on this profile, the lake had not stratified either thermally or chemically (Figure 7.10).

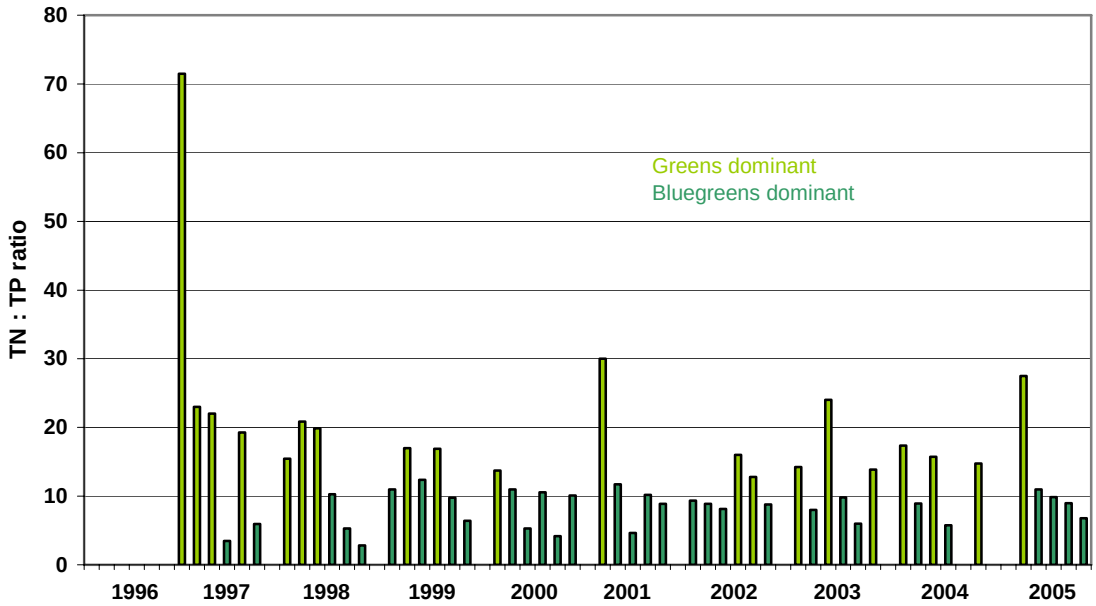


Figure 7.6. Graph of total nitrogen : total phosphorus ratio (TN:TP) by sample from 1997 through 2005 at Kanopolis Lake Site 3 (dam).

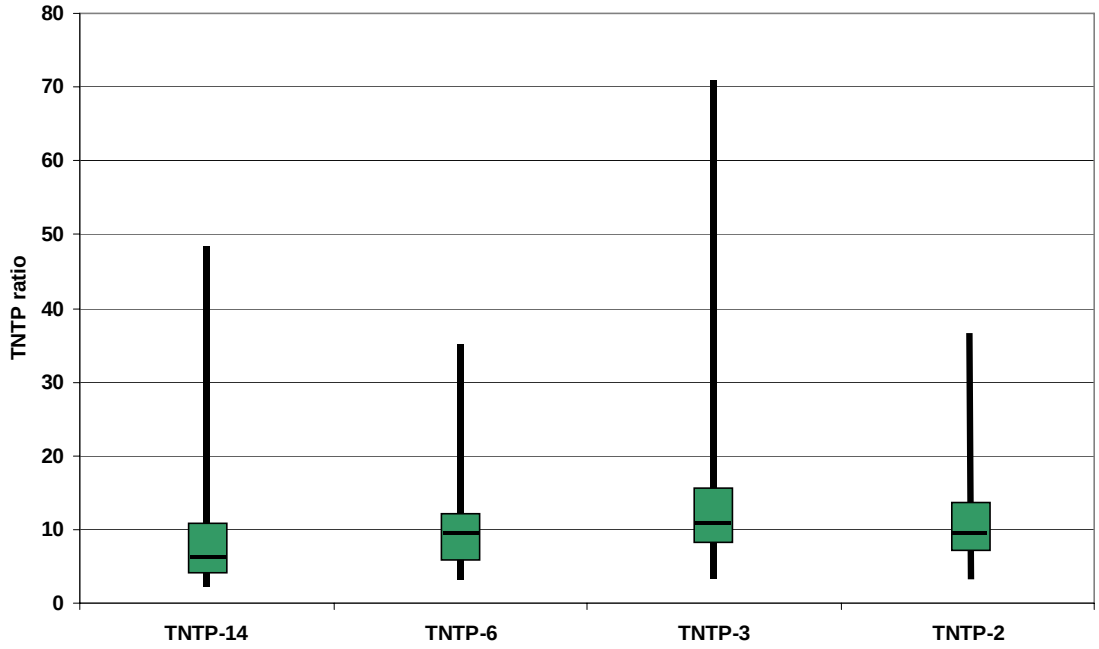


Figure 7.7. Box plots of total nitrogen : total phosphorus (TN : TP) ratio by site from samples collected between 1997 – 2005 at Kanopolis Lake.

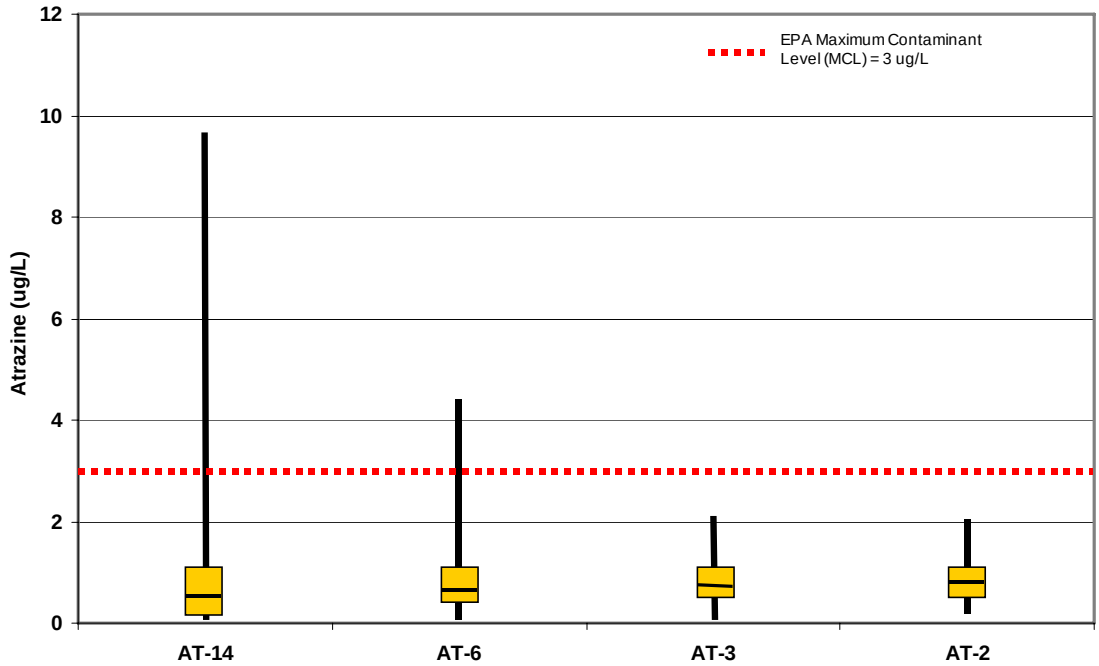


Figure 7.8. Box plot of surface water sample atrazine concentrations measured at lake sites from 1996 through 2005 at Kanopolis Lake.

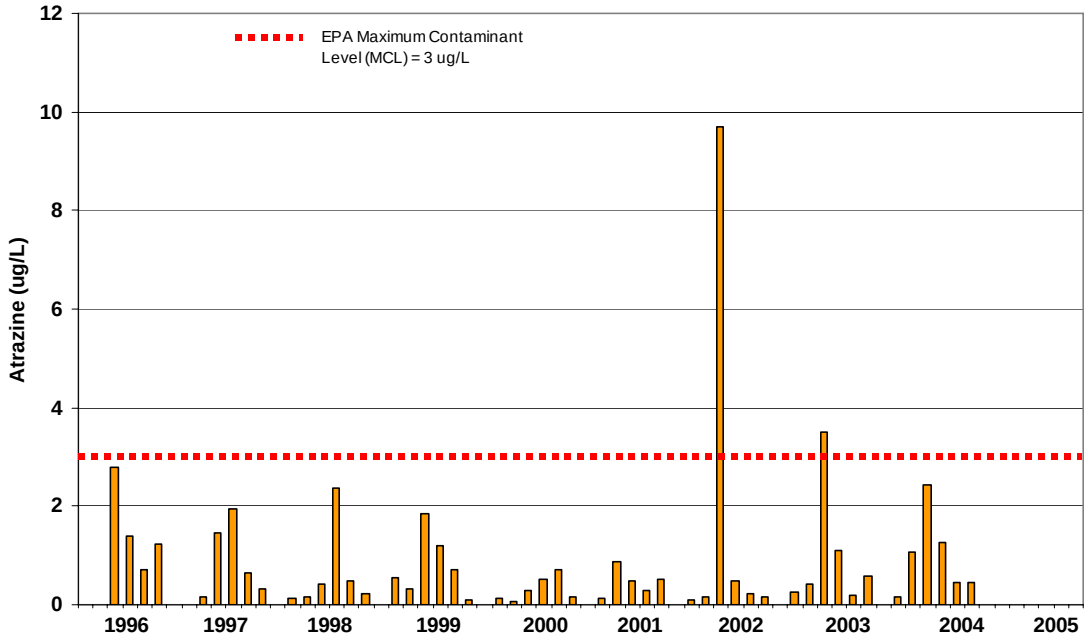
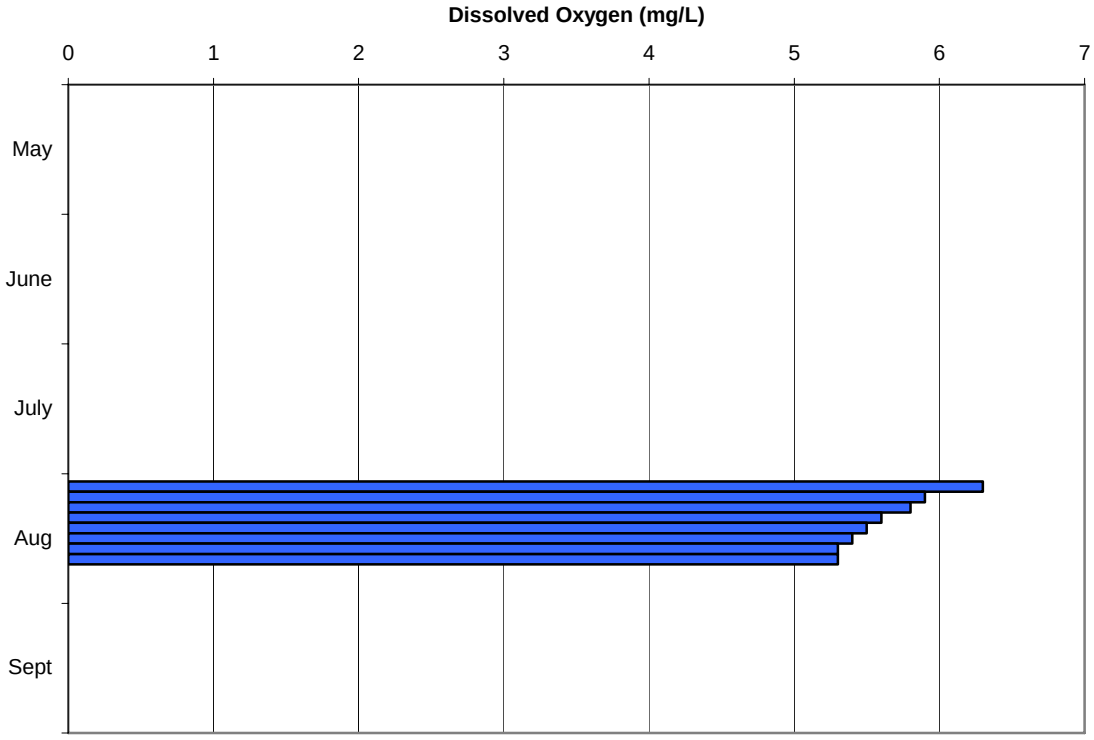


Figure 7.9. Atrazine concentrations by date for samples collected between 1996 and 2004 at Site 14 (Smoky Hill River inflow) in the Kanopolis Lake watershed.



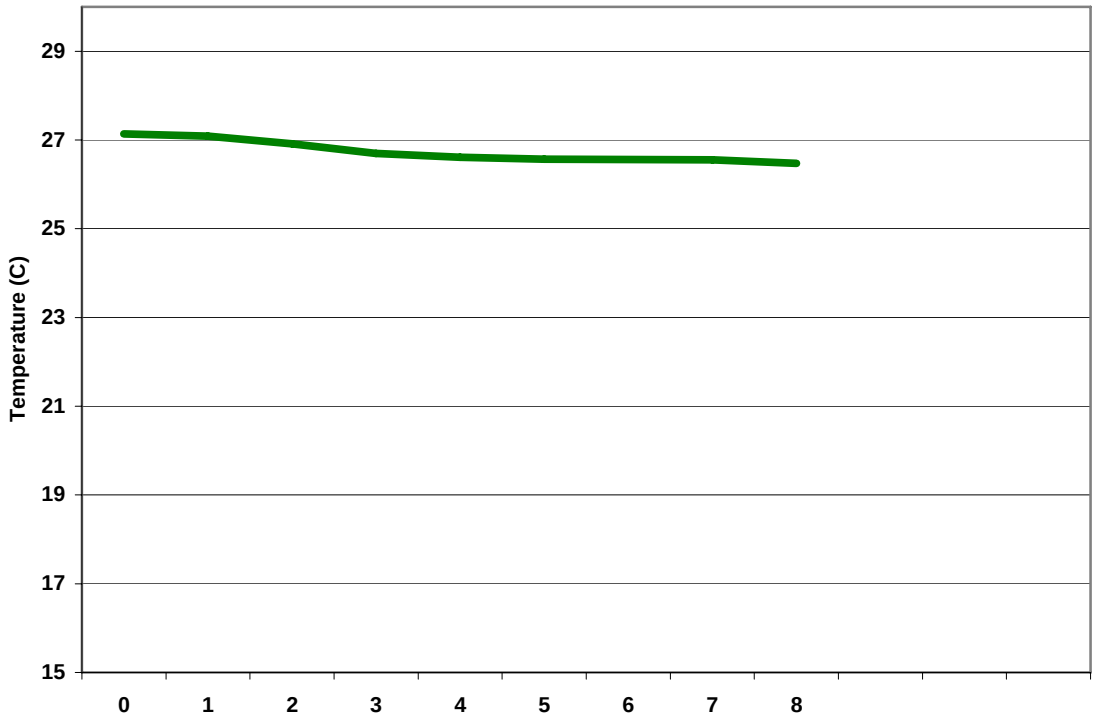


Figure 7.10. Dissolved oxygen concentration (mg/L) histogram and temperature (C) plot from a vertical profile recorded at Site 3 during 20 July 2005 at Kanopolis Lake.

7.3.3 Outflow

No outflow samples were collected from Kanopolis Lake during 2005.

7.4 Future Activities and Recommendations

Sampling activities for 2006 will include transition to monthly 'intensive' monitoring from April through September, as well as conducting monthly vertical profiles at each of the two lake sites. An additional watershed site will be added (Site 20) at the Highway 281 bridge crossing of the Smoky Hill River, approximately 40 river miles upstream of the existing upper site. This will provide valuable data to better track upper watershed issues. In addition, the Smoky Hill / Big Creek WRAPs group is considering stormevent monitoring at five locations in the upper watershed. Specific details on such sampling have yet to be resolved.